

NCERT CBSE Solutions for Class 10 Science Chapter 2

Acid, Bases and Salts

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1. A solution turns red litmus blue; its pH is likely to be:

- (A) 1
- (B) 4
- (C) 5
- (D) 10

Solution: (D)

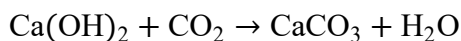
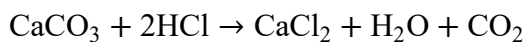
A solution which turns the colour of red litmus to blue must be basic in nature. A basic solution has a pH value of greater than 7. The only option with pH greater than 7 is 10 which will be the correct answer.

2. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains:

- (A) NaCl
- (B) HCl
- (C) LiCl
- (D) KCl

Solution: (B)

Egg shells are made up of calcium carbonate, which on reaction with HCl liberates CO_2 gas. When CO_2 reacts with lime water ($\text{Ca}(\text{OH})_2$), it forms calcium carbonate which gives the solution a milky appearance.



3. 10 ml of a solution of NaOH is found to be completely neutralized by 8 mL of a given solution of HCl. If we take 20 ml of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralize it will be:

- (A) 4 ml
- (B) 8 ml
- (C) 12 ml
- (D) 16 ml

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Solution: (D)

The amount of Hydroxide ions and hydrogen ions are directly proportional to the volume of their respective solutions. Hence, the problem can be solved by a unitary method

Since 10 ml NaOH reacts with = 8 ml HCl

Therefore, 20 ml NaOH react with = $(8/10) \times 20 = 16$ ml HCl

\therefore 16 ml of HCl solution will be required to completely neutralize 20 ml of NaOH solution.

4. Which of the following types of medicines is used for treating indigestion?

- (A) Antibiotic
- (B) Analgesic
- (C) Antacid
- (D) Antiseptic

Solution: (C)

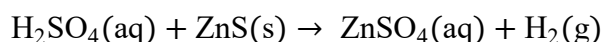
An antacid is used for the treatment of indigestion which is caused due to excessive acidity in the stomach. The antacid chemical is basic in nature and thus, it neutralizes the acidity in the stomach.

5. Write word equations and then balanced equations for the reaction taking place when

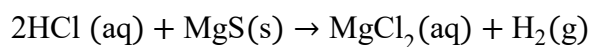
- (i) Dilute sulphuric acid reacts with zinc granules.
- (ii) Dilute hydrochloric acid reacts with magnesium ribbon.
- (iii) Dilute sulphuric acid reacts with aluminium powder.
- (iv) Dilute hydrochloric acid reacts with iron filings.

Solution:

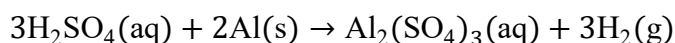
(i) Sulphuric acid + Zinc \rightarrow Zinc sulphate + Hydrogen



(ii) Hydrochloric acid + Magnesium \rightarrow Magnesium chloride + Hydrogen

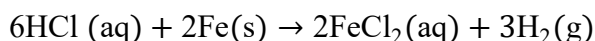


(iii) Sulphuric acid + Aluminium \rightarrow Aluminium sulphate + Hydrogen



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(iv) Hydrochloric acid + Iron Ferrous chloride + Hydrogen



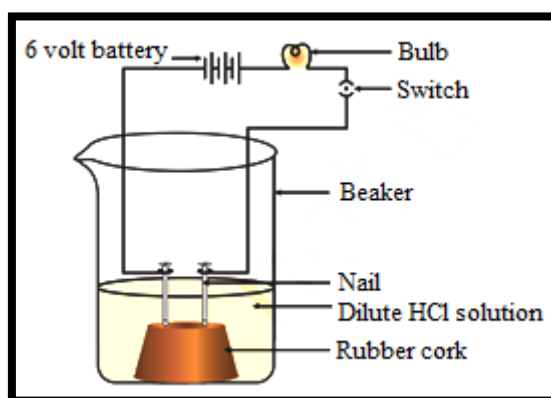
6. Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

Solution:

Two nails are fitted on a cork and are kept in a 100 ml beaker. The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch. Some dilute HCl is poured into the beaker and the current is switched on. The same experiment is then performed with a glucose solution and an alcohol solution.

Observations:

It will be observed that the bulb glows in the HCl solution and does not glow in the glucose or alcohol solution.



Result:

HCl dissociates into H^+ and Cl^- ions. These ions conduct electricity in the solution resulting in the glowing of the bulb. On the other hand, neither the glucose solution nor the alcohol solution dissociates into ions. Therefore, these two solutions do not conduct electricity.

Conclusion:

From this activity, it can be concluded that all acids generate hydrogen ions but not all compounds containing hydrogen are acids.

That is why, though alcohols and glucose contain hydrogen, they are not categorized as acids.

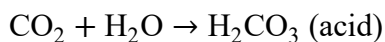
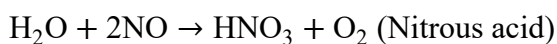
7. Why does distilled water not conduct electricity, whereas rainwater does?

Solution:

Distilled water is a pure form of water and its pH is 7 and is devoid of any ionic species. Therefore, it does not conduct electricity. Rainwater, being an impure form of water, contains CO_2 , SO_2 , NO . These oxide gases react with water and get chemically converted into acids which are responsible for the

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release of ions that conduct electricity-contains many ionic species(acids) whose pH is less than 7 and therefore it conducts electricity



8. Why do acids not show acidic behaviour in the absence of water?

Solution:

A substance is said to be acidic when it can generate hydrogen ions (H^+). The hydrogen ion generally comes from the acid which dissociates in the presence of water. Thus, for acid to dissociate into hydrogen ion and the respective anion, water must be present. Hence, an acid fails to show its acidic behaviour in the absence of water.

9. Five solutions A, B, C, D, and E, when tested with universal indicator, showed pH as 4, 1, 11, 7 and 9, respectively. Which solution is

- (i) Neutral?
- (ii) Strongly alkaline?
- (iii) Strongly acidic?
- (iv) Weakly acidic?
- (v) Weakly alkaline?

Arrange the pH in increasing order of hydrogen-ion concentration.

Solution:

At 25°C pH of neutral solutions = 7

As the pH falls below 7, it denotes acidic character with a pH of 1 being highly acidic. When the pH goes above 7, it implies that the solution is basic with 14 being highly basic.

- (i) Neutral Solution D with pH 7
- (ii) Strongly alkaline Solution C with pH 11
- (iii) Strongly acidic Solution B with pH 1
- (iv) Weakly acidic Solution A with pH 4
- (v) Weakly alkaline Solution E with pH 9

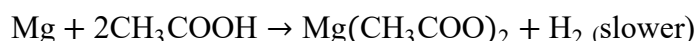
10. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid

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(CH₃COOH) is added to test tube B. Amount and concentration taken for both the acids are same. In which test tube will the fizzing occur more vigorously and why?

Solution:

The fizzing will occur strongly in test tube A, in which hydrochloric acid (HCl) is added. This is because HCl is a stronger acid than CH₃COOH and therefore produces hydrogen gas at a quicker rate due to which fizzing occurs more vigorously in test tube A.



11. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.

Solution:

The pH of milk is 6. As it gets converted to curd (pH between 4.5 to 5.5) the pH will reduce because curd has lactic acid which is more acidic in nature. Thus, the pH drops below 6 when milk gets converted to curd.

12. A milkman adds a very small amount of baking soda to fresh milk.

- (i) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
- (ii) Why does this milk take a long time to set as curd?

Solution:

- (i) The milkman adds a small amount of baking soda to shift the pH of the fresh milk from 6 to slightly alkaline because in alkaline condition, milk does not set as curd easily and this helps in preventing the milk from getting converted to curd.
- (ii) Since this milk is slightly basic than usual milk, acids produced to set the curd are neutralized by the base. Only when the alkalinity of milk is neutralized, the process of curd formation begins. Therefore, it takes a longer time for the curd to set.

13. Plaster of Paris should be stored in a moisture-proof container. Explain why?

Solution:

Plaster of Paris (POP) should be stored in a moisture-proof container because Plaster of Paris, a powdery mass, absorbs water (moisture) to form a hard solid known as gypsum.



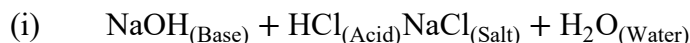
14. What is a neutralization reaction? Give two examples.

Solution:

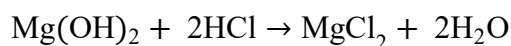
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A reaction in which an acid and a base react with each other to give a salt and water is termed as a neutralization reaction. In this reaction, energy is evolved in the form of heat and thus, such reactions are usually exothermic by nature.

Example:



- (ii) During indigestion (caused due to the production of excess of hydrochloric acid in the stomach), we administer an antacid (generally milk of magnesia, $\text{Mg}(\text{OH})_2$ which is basic in nature). The antacid neutralizes the excess acid and thus gives relief from indigestion.



15. Give two important uses of washing soda and baking soda.

Solution:

Two important uses of washing soda are as follows:

- It is used in glass, soap, and paper industries.
- It is used to remove the permanent hardness of the water.

Two important uses of baking soda are as follows:

- It is used in baking industries. Baking powder is a mixture of baking soda and a mild acid known as tartaric acid. When it is heated or mixed with water, it releases CO_2 that makes bread or cake fluffy.
- It is used in soda-acid fire extinguishers.



In-Text Questions

1. You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a basic solution, respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?

Solution:

Few drops of each solution from the test tubes are added to red litmus paper separately.

- The solution which turns red litmus to blue is the basic solution. Use this blue litmus paper to test the solutions in the other two test tubes.
- The solution which turns blue litmus paper to red will be the acidic solution.
- The solution which does not change the colour of either red or blue litmus paper to blue or red contains distilled water.

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2. Why should curd and sour substances not be kept in brass and copper vessels?

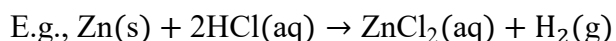
Solution:

Curd and sour substances contain acids. These acids can react with brass and copper vessels to form toxic compounds. This makes the substances unfit for human consumption. Hence, they are not kept in brass and copper vessels.

3. Which gas is usually liberated when an acid reacts with a metal? Illustrate with an example. How will you test for the presence of this gas?

Solution:

Hydrogen gas is usually liberated when an acid reacts with a metal.



The equation given above illustrates how zinc reacts with dilute hydrochloric acid resulting in the liberation of hydrogen gas and the formation of the salt zinc chloride.

A burning match stick, when brought near the mouth of the test tube where H_2 gas is being released makes a pop sound. This confirms the presence of hydrogen gas.

4. Metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride.

Solution:

Metal compound A is Calcium carbonate (CaCO_3). When A reacts with dilute hydrochloric acid it produces effervescence. The chemical equation is given as:



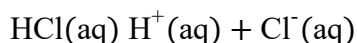
The gas evolved is CO_2 . CO_2 extinguishes a burning candle.

5. Why do HCl , HNO_3 , etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

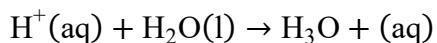
Solution:

When HCl or HNO_3 are mixed with water, they dissolve in water to form H^+ or H_3O^+ ions which show their acidic character.

Example



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Solutions of compounds like alcohol and glucose do not dissolve to form any such ions. Hence, they do not show any acidic character.

6. Why does an aqueous solution of acid conduct electricity?

Solution:

An acid dissolves in water and dissociates to form H^+ or H_3O^+ ions. Electricity is conducted through these moving ions.

7. Why does dry HCl gas not change the colour of the dry litmus paper?

Solution:

Dry HCl gas does not dissociate into H^+ ions and hence, the acidic property of gas is not impaired. So dry HCl gas does not change the colour of the dry litmus paper.

8. While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

Solution:

The process of adding water to acid is highly exothermic. If not done very carefully the acid may splash, cause burns and even the bottle/container can break due to the vigorous reaction. To avoid this and to allow the heat evolved to be absorbed by water slowly, the acid is added to water for diluting it. This significantly reduces the risk of splashing.

9. How is the concentration of hydronium ions H_3O^+ affected when a solution of an acid is diluted?

Solution:

When the solution of acid is diluted then the concentration of hydronium ion H_3O^+ per unit volume decreases. On adding water, the H^+ ions of the acid and hydroxyl ions of water react to form water molecules and the concentration of hydronium ions decreases.

10. How is the concentration of hydroxide ions OH^- affected when excess base is dissolved in a solution of sodium hydroxide?

Solution:

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When the base is mixed with sodium hydroxide solution there is an increase in the number of hydroxide ions whereas the volume remains almost the same. This leads to an increase in the concentration of OH^- ions per unit volume.

11. You have two solutions, A and B. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?

Solution:

Solutions with $\text{pH} < 7$ are said to be acidic.

Solutions with $\text{pH} = 7$ are neutral and $\text{pH} > 7$ are basic.

Therefore, Solution A with $\text{pH} = 6$ is acidic and Solution B with $\text{pH} = 8$ is basic.

So 'A' has more hydrogen ion concentration.

12. What effect does the concentration of $\text{H}^+(\text{aq})$ ions have on the nature of the solution?

Solution:

The higher the concentration of $\text{H}^+(\text{aq})$ ions, the more is its acidic nature.

13. Do basic solutions also have $\text{H}^+(\text{aq})$ ions? If yes, then why are these basic?

Solution:

Yes, basic solutions also have H^+ ions, but they are basic in nature due to a greater number of OH^- ions than the H^+ ions.

14. Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate)?

Solution:

Quick lime (calcium oxide), slaked lime (calcium hydroxide) and chalk (calcium carbonate) are all basic in nature. When the soil becomes more acidic in nature, the farmer would add quicklime CaO or slaked lime CaOH_2 or chalk CaCO_3 to make it neutral. This helps the farmer to make the soil fit to grow his crops.

15. What is the common name of the compound CaOCl_2 ?

Solution:

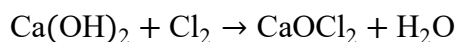
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CaOCl_2 (chemical name-calcium oxychloride) is commonly called bleaching powder.

16. Name the substance which on treatment with chlorine yields bleaching powder.

Solution:

Bleaching powder is prepared by treating Calcium hydroxide Ca(OH)_2 with chlorine. The chemical equation for the reaction is:



17. Name the sodium compound which is used for softening hard water.

Solution:

Sodium carbonate is commonly used for softening hard water.

18. What will happen if a solution of sodium hydrogen carbonate is heated? Give the equation of the reaction involved.

Solution:

When sodium hydrogen carbonate (NaHCO_3) is heated, sodium carbonate, water and carbon dioxide gas are obtained. The chemical equation for the reaction is



19. Write an equation to show the reaction between Plaster of Paris and water.

Solution:

Plaster of Paris is $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$. The reaction between the Plaster of Paris and water is given as:

